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भाग 2 परिवर्तन कारक ज्ञात करना

Indian Standard

MEDICAL ELECTRICAL EQUIPMENT CHARACTERISTICS OF ELECTRO-OPTICAL X-RAY IMAGE INTENSIFIERS

PART 2 DETERMINATION OF THE CONVERSION FACTOR

ICS 11.040.50

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Price Group 4

Ionizing Radiation Imaging and Radiotherapy Equipment Sectional Committee, MHD 18

NATIONAL FOREWORD

This Indian Standard (Part 2) which is identical with IEC 61262-2 : 1994 Medical electrical equipment — Characteristics of electro-optical X-ray image intensifiers — Part 2: Determination of the conversion factor' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of Ionizing Radiation Imaging and Radiotherapy Equipment Sectional Committee and approval of the Medical Equipment and Hospital Planning Division Council.

This standard was first published in 1993 as IS 13813 : 1993 by adopting IEC Pub 573 : 1-977. IEC Pub 573 :1977 had been withdrawn and replaced by IEC 61262-2 :1994.This standard will therefore, supersedes IS 13813:1993'Measurement of the conversion factor of electro-optical X-ray image intensifiers' and after the publication of this standard IS 13813 :1993 shall be treated as withdrawn.

IEC 61262 has been published in various parts. The other parts which have been adopted so far are:

Part 1	Determination of the entrance field size
Part 3	Determination of the luminance distribution and luminance non-uniformity
Part 4	Determination of image distortion *{underpreparation)*

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standard while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to the following International Standard for which Indian Standard also exists.The corresponding Indian Standard which is to be substituted in its place is listed below along with its degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 788:1984[1] Medical radiology — Terminology	IS 13807 : 1994 Medical radiology — Terminology	Identical

The technical committee responsible for the preparation of this standard has reviewed the provisions of the following International Standard referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

International Standard	*Title*
IEC 731 :1982	Medical electrical equipment — Dosimeters with ionization chambers as used in radiotherapy

Only the English language text of the International Standard has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in the IEC Standard.

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[1] Since revised in 2004.

(*Continued on third cover)*

Indian Standard

MEDICAL ELECTRICAL EQUIPMENT CHARACTERISTICS OF ELECTRO-OPTICAL X-RAY IMAGE INTENSIFIERS

PART 2 DETERMINATION OF THE CONVERSION FACTOR

1 Scope

This International Standard applies to electro-optical X-ray image intensifiers for medical use, as components of diagnostic X-ray equipment.

This International Standard describes a method of determining the conversion factor of X-ray image intensifiers.

It is applicable only to devices whose output light spectra do not significantly deviate from that of a P-20 phosphor.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Internationa! Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 788: 1984, *Medical Radiology - Terminology*

3 Terminology

3.1 *Definitions*

For the purposes of this International Standard, the following definitions apply together with those given in IEC 788. The definitions given below take preference over those given in IEC 788 when differences occur.

3.1.1 *XRII:* An abbreviation for electro-optical X-ray image intensifier.

3.1.2 *Entrance plane*: The plane perpendicular to the axis of symmetry of the XRII and gra2ing the part of the XRII, including its housing, that protrudes most in the direction of the radiation source.

3.1.3 *Entrance field*: For an XRII, the area in the entrance plane that can be used for the transmission of an X-ray pattern under specific conditions.

3.1.4 *Entrance field size*: For an XRII, the diameter of the field in the entrance plane that can be used at a specified SED for the transmission of an X-ray pattern. For an XRII with more than one magnification mode, the entrance field size for each of the magnification modes shall correspond to the same diameter of the XRII output image occuring with the largest entrance field size.

3.1.5 *SOURCE TO ENTRANCE PLANE DISTANCE* (*abbreviation: SED*): The distance between the FOCAL SPOT of the X-ray tube and the entrance plane of the XRI1.

3.1.6 *CENTRE OF THE OUTPUT IMAGE*: The centre of the smallest circle circumscribing the OUTPUT IMAGE.

3.1.7 *CENTRE OF THE ENTRANCE FIELD*: That point in the entrance plane which is imaged at the CENTRE OF THE OUTPUT IMAGE.

3.1.8 *CENTRAL AXIS*: The line perpendicular to the entrance plane passing through the CENTRE OF THE ENTRANCE FIELD.

3.1.9 Not used

3.1.10 *CONVERSION FACTOR*: The ratio of the luminance in the CENTRE OF THE OUTPUT IMAGE of a specific zone in the OUTPUT IMAGE to the AIR KERMA RATE in the CENTRE OF THE ENTRANCE FIELD.

3.2 *Degree of requirements and reading instructions*

In this International Standard the auxiliary verb:

-"shall"	implies that compliance with a requirement is mandatory for compliance with the standard;
- "should"	implies that compliance with a requirement is strongly recommended but is not mandatory for compliance with the standard;
-"may"	implies that compliance with a requirement is permitted to be accomplished in a particular manner, for compliance with the standard;

and the following words have the meaning:

- "specific"	when used in combination with parameters or conditions: refers to a particular value or standardized arrangement, usually to those required in an IEC standard or a legal requirement; see IEC788, rm-74-01.
- "specified"	when used in combination with parameters or conditions: refers to a value or arrangement to be chosen for the purpose under consideration and indicated usually in the accompanying documents; see IEC 788. rm-74-02.
- "designed for"	when used in standards to characterize equipment, devices, components or arrangements: designates an intended and usually apparent purpose or use for the product.

4 Requirements

4.1 *Test set-up*

a) The SED shall be 100 cm ± 1 cm,

b) The FOCAL SPOT of the X-RAY TUBE shall be on the CENTRAL AXIS.

c) The distance between the FOCAL SPOT of the X-RAY TUBE and any ADDED FILTERS shall not exceed 33 cm.

d) The X-RAY FIELD shall cover the ENTRANCE FIELD entirely, but its area shall not exceed the ENTRANCE FIELD area by more than 10 %.

This limitation of the X-RAY FIELD shall be made by a DIAPHRAGM placed immediately in front of the ENTRANCE PLANE. The BEAM LIMITING DEVICE of the X-RAY SOURCE ASSEMBLY shall be used to limit the X-RAY BEAM on this DIAPHRAGM. The DIAPHRAGM shall provide an ATTENUATION RATIO of at least 100 for the quantity AIR KERMA RATE.

e) The CONVERSION FACTOR varies with temperature and the measurements shall refer to normal room temperatures {i.e. 23 °C ± 3 °C).

4.2 *X-RAY IMAGE INTENSIRER - Operating conditions*

a) The XRII shat! be operated under the conditions for NORMAL USE as specified by the manufacturer.

b) No ANTI-SCATTER GRID or protective cover shall be used.

c) In the case of multiple-field XRIIs, the measurement shall be made for the largest specified ENTRANCE FIELD. Measurements for other ENTRANCE FIELDS are optional.

4.3 *Input radiation*

a) The TOTAL FILTRATION of the incident X-RAY BEAM shall be 22,5 mm ± 0,5 mm of aluminium equivalent of which at least 20 mm is aluminium (99,9 % purity). The HALF-VALUE LAYER at the position corresponding to the CENTRE OF THE ENTRANCE FIELD shall be 7,0 mm Al ± 0,2 mm Al (99,9 % purity). This condition corresponds to an approximate X-RAY TUBE VOLTAGE of 75 kv*.

b) The AIR KERMA RATE in the ENTRANCE PLANE shall be such that linear operation of the XRI! and the detectors employed in the measurement is ensured. An AIR KERMA RATE of 1 uGy s'^{1} to 100 uGy s''' is recommended.

c) The temporal fluctuations of the AIR KERMA RATE shall not impair the measurement accuracy by more than 2 %. As the AIR KERMA RATE measurements and the luminance measurements are made at different time instances, the X-RaY TUBE output shall be monitored and the results of the measurements shall be corrected to meet this requirement.

d) The AIR KERMA RATE at any location in the ENTRANCE FIELD shall not be less than 70 % of the highest value of the AIR KERMA RATE in the ENTRANCE FIELD.

4.4 *TEST DEVICE*

Not used.

4.5 *Measurement equipment*

4.5.1 *Device for measuring the AIR KERMA RATE*

The device shall be accurate to within ±5 %.

4.5.2 *Device for measuring the luminance of the OUTPUT SCREEN*

a) The device shall measure the luminance in the direction perpendicular to the plane defined by the OUTPUT SCREEN.

If the angular distribution of the luminance deviates by more than 25 % from Lamberts' law within a range of 0 ° up to 30 ° with respect to the perpendicular of the OUTPUT IMAGE, the measurement should be carried out with an acceptance angle 5 ° maximum and its variation as a function of the angle should be given.

b) The device shall be accurate to within ±5 %.

c) The instrument shall have a spectral sensitivity corresponding to the standardized curve V_x of the human eye under photopic conditions.

See: CIE Publication No. 15 (1971), Colorimetry, International Commission on Illumination.

5 Determination of the CONVERSION FACTOR

5.1 *Preparation*

a) The requirements for the measurement set-up given in 4.1 shall be fulfilled.

b) The TOTAL FILTRATION of the RADIATION BEAM and the X-RAY TUBE VOLTAGE are adjusted according to 4.3 a) to obtain the required HALF-VALUE LAYER at the position corresponding to the CENTRE OF THE ENTRANCE FIELD according to 4.1.

5.2 *Measurement*

5.2.1 *Measurement of the AIR KERMA RATE*

a) After the determination of the ENTRANCE PLANE and the CENTRE OF THE ENTRANCE FIELD, the XRII is removed from the beam. No objects capable of scattering X-RADIATION shall remain in the X-RAY BEAM at a distance less than 50 cm from the ENTRANCE PLANE according to 4.1*

b) The measuring device shall be positioned such that its sensitive area is located in the ENTRANCE PLANE and centred around the CENTRE OF THE ENTRANCE FIELD.

NOTE - For thick detectors the REFERENCE *POINT* as defined in IEC 731 should be placed at the CENTRE OF THE ENTRANCE FIELD.

c) The sensitive area of the measuring device shall be such that the uniformity of the AIR KERMA RATE inside that area is better than 3 %.

d) If the indication of the measuring device depends on the air-pressure, the measuring results shall be corrected accordingly.

5.2.2 *Measurement of the OUTPUT SCREEN luminance*

a) The XRII shall be positioned as stated in 4.1.

b) The X-RAY TUBE output radiation shall be adjusted to the same level as during the AIR KERMA RATE measurement.

c) The centre of the measured area shall be located at the CENTRE OF THE OUTPUT IMAGE.

d) The diagonal of the effective area of the measuring field shall be at least 0,1 mm and shall not exceed 5 % of the OUTPUT IMAGE diameter.

e) The device for measuring the AIR KERMA RATE shall be removed.

5.3 *Corrections*

Not used.

5.4 *Determination*

The CONVERSION FACTOR, G_{x1} shall be determined from the expression:

$$G_X = L/K'$$

where the luminance L is expressed in cd m^{-2} and the AIR KERMA RATE K' is expressed in uGy s^{-1}

NOTE - An EXPOSURE RATE of 1 mR s^{-1} corresponds to an AIR KERMA RATE of 8,7 uGy s^{-1}

The uncertainty of the result shall not exceed ±15 %.

6 Presentation of the CONVERSION FACTOR

The presentation of the CONVERSION FACTOR shall include the following:

- XRII identification, e.g., generic type, model name or number.
- The CONVERSION FACTOR expressed in cd m^{-2} / uGy s^{-1}

  The relative spectral intensity distribution of the light emitted from the OUTPUT SCREEN of the X-RAY IMAGE INTENSIFIER to be given in the ACCOMPANYING DOCUMENTS either as a curve or a table.

and optionally:

- The ENTRANCE FIELD SIZE, only for results with an additional ENTRANCE FIELD.

7 Statement of compliance

If compliance with this standard for the determination of the CONVERSION FACTOR of X-RAY IMAGE INTENSIFIERS is to be stated, it shall be indicated as:

- Conversion factor: IEC 1262-2 : 1994.

Annex A
(informative)

Terminology - Index of terms

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Name of unit in the international System SI	rm-..-..*
Derived term without definition	rnv..-..+
Term without definition	rm-..-..-
Name of earlier unit	rm-..-..*
Shortened term	rm-..-..s
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Annex B

(informative)

Bibliography

IEC 731: 1982, *Medical electrical equipment - Dosimeters with ionization chambers as used in radiotherapy*

CIE Publication No. 15 (1971), *Colorimetry****,*** *International Commission on Illumination*

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(Continued from second cover)

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 :1960 'Rules for rounding off numerical values *(revised)'.* The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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